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SCIENCE

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SOME RESPONSIBILITIES OF BOTANICAL SCIENCE¹

WHEN this meeting of the American Association for the Advancement of Science was first announced it was the expectation of all of us that our discussions and deliberations here would center primarily about the immediate and practical needs of a time of war. In those days the thought seemed common in this country, that it was the plain duty of scientists to lay their more remote aims aside for the time being and to devote their energies almost entirely to practicalities, the practicalities of those great martial undertakings whose wonderfully successful results have only just now passed into history. But it has become clear that the needs of a modern militant nation are not merely men and money; the ramifications of these needs seem to have led into nearly every cranny of human activity, so that almost every person has found ways by which his special fitness, for some activities rather than for others, might be utilized in this grand mobilization of the nation as a whole. In very many cases it has appeared that the more remote aims of those whose activities are primarily intellectual and spiritual are not to be laid wholly aside at the sounding of the trumpet of war and at the waving of the battle flag. It has emerged that most or all of those activities that may truthfully be called essential for peace and for the general advancement, are also essential in time of war. Details have required alteration, but the war has led, on the whole, rather to an acceleration, to a speeding-up of the majority of productive peace activities, rather than to the laying of such activities aside.

War differs from peace rather in degree than

¹ Address of the chairman and vice-president of Section G—Botany, American Association for the Advancement of Science, Baltimore, December, 1918.

in kind. It calls for a mobilization—which is a planned cooperation—of all the valuable and worthy activities of the nation. And just such a mobilization was proceeding with ever-increasing strides in this country, until the news of the present armistice announced the need for still further changes of detail. Let us hope that the spirit of planned activity, aroused from the magic lamp of human nature by the rubbing of a martial hand, may not be sent to rest with the return of peace. The civilized world has found again that the greatest human pleasures and satisfactions may come from the giving of money and goods and heartbeats and even the life-blood of many individuals, all for the furthering of the same worthy cause. It has found that national and world mobilization are the means whereby great works may be rapidly achieved, it has found that cooperation between individuals and between states is the means whereby the pleasures of the accomplishment of such works are to be most quickly attained. In order that we and those who follow us may enjoy these great pleasures of accomplishment, let us strive to keep the spirit of cooperation alive and aggressively active against the false demons of the more primitive and more frequently prevailing forms of selfishness, and let us move forward, with this spirit in our hearts, into the era that is now dawning.

The burden of my words to you this afternoon will be to ask you to pass, for a few minutes, out of the work-a-day world of selfish struggles for “credit” or “priority” in scientific literature, or for salary increase and the like of that, out of the world of minute detail with its microscope lenses and balance pans, and to dwell for a little while on some of the larger possibilities and opportunities that lie before botanical science at this time. And I shall wish to emphasize the idea that, for a goodly number of us, at any rate, these possibilities and opportunities are tasks and responsibilities that really and truly need to be met.

It is well first to realize that those who devote their lives to science have peculiar responsibilities. The body of human knowledge

has grown apace and constitutes our most cherished possession. It alone can be handed on to the coming generations; other human achievements wear out and disintegrate with time, while knowledge lasts and grows and increases in value as our race matures. Whatever may be your idea of the final good of human life, whether it be to glorify God or wallop the devil, to give ourselves pleasure in the present or in the future, or to give to coming generations a better chance to live as they will wish to live—no matter at what particular angle you may view these academic questions of ultimate results, you will surely agree that the preservation of real knowledge is one of our responsibilities. We and our posterity will have great need for all the knowledge that is available, to-morrow and the day after, and one of our world responsibilities is clearly to see that knowledge once gained shall not be lost.

But this is not all. It is not sufficient for a healthy human being to act merely as a vestal, simply to keep a torch burning that was kindled by others. It is our instinct to increase the body of science as well as to preserve what has been accomplished, and instinct appears to accord with reason here, for if knowledge is valuable it should be increased as rapidly as possible. This is, then, another of our world-responsibilities.

To preserve for the future all that is known of ourselves and of the universe about us, to make this knowledge ever more readily available, and to add to the store as we work it over and hand it on to others, these seem to be the prime responsibilities of human beings, as distinguished from other organisms. Now, if these things are to be done there is no group of society so fitted to do them as is the group of scientists; upon them has fallen the mantle of the vestal and that of the priest. Society, as a whole, relies on scientists for these things and these responsibilities are especially ours.

It has frequently seemed to me that we, as a group, fulfill these requirements with a maximum of friction and waste and with a minimum of efficiency. At least it is not difficult for a dreamer or an idealist to suggest general

ways by which our service to humanity might be greatly enhanced. If improvements might be introduced each individual might find more pleasure than is now possible, in his own work and in that of the group, and it seems just now to be an opportune time to take some thought as to possible ways by which our social function as scientists may become more satisfactory, both to ourselves and to those outside of our group. A kind of idealism has succeeded in winning the war, and he who runs may read that this was a war of science, and that it was through science that it was finally won. Consequently, I may not be too bold if I here pass in review some of the suggestions for an improved science that have come to me in one way or another.

In the first place, ever since my student days it has seemed very strange to me that the devotees of science lay so little stress on the broader and more general aspects of their work and upon the aims that are held in view. Our introductory books plunge the beginner into a maze of concrete detail, without attending to the orientation that every beginner needs. Our teaching of beginners follows our texts, or else our texts follow our teaching. We imply that this general orientation, this appreciation of the relations between our particular small chapter of science and the great body of human knowledge, will care for itself, without conscious attention. We see that our students learn how to weigh a seed or how to stain a chromosome, and we strive to give them a digest of all that is so far known of seeds or chromosomes, but it is only seldom that the very need for such knowledge receives adequate attention. I am not sure whether botanical science is to be criticized more in this respect than other branches, but I am sure that the criticism is justly to be considered by botanists of all sorts.

Obviously the matter has lain largely in a lack of *esprit du corps* among botanists; we have largely failed to be conscious of our responsibility as a group. We have not taken the trouble to find out what we can agree on, and an outsider feels that we can not agree

on anything at all. As the late Professor Bessey remarked of botanical research, the work of botanical science is carried on by a sort of guerilla warfare, each botanist for himself. To speed up our work in all lines we need more team-play, as it were. We need to have somewhat clearly in mind what, indeed, our activities are all about. If we might attend to these matters of orientation we ought to be able, then, to emphasize certain sorts of work that are to be regarded as the more important, for the present.

The answer to the question as to how guerilla warfare, without *esprit du corps* and without conscious aims, is to be metamorphosed into a planned and productive campaign, lies, I am almost certain, in the connotation of the word cooperation. As we mobilized ourselves and laid aside our individual differences of opinion or faith, in order to help in the winning of the war, even so (if we thought it important enough) we might mobilize ourselves for the rational acceleration of the work of botanical and other sciences. One of our greatest responsibilities right now is to orient ourselves as a group and to plan our campaign of work for the immediate future.

The group of botanists is an international group and our mobilization should aim to be international finally, but it were well if the botanists of this country might put their own house in order as a first move toward the setting up of conscious aims and planned campaigns by the world group. In the meantime, botanical scientists of other countries may be doing likewise, and the International Association, or some other organization, might become the means of bringing the national groups into a single whole.

Turning to matters a little more concrete, I suggest that there are two quite different kinds of aims or objects, toward which we may strive. The first of these has to do with our responsibility to *preserve* botanical knowledge, to make it available for all sorts of application, and to pass it on to the next and later generations. The second kind of aim deals with our responsibility, to *add to* botan-

ical knowledge. I should like to consider certain ideas with reference to each of these two general aims.

The Conservation of Knowledge Already Attained.—My first topic, on the conservation and presentation of knowledge already at hand, involves the teaching of students and the publishing of résumés, year-books, abstract journals, and the like. The teaching aspect I shall not venture to take up here; the atmosphere is at present somewhat hazy with discussions on botanical, zoological and biological teaching, questionnaires on these topics flit frequently through the mails, and this whole matter seems to be receiving considerable attention at the hands of teaching botanists. Also, it seems well for your vice-president to take no sides on these questions at present, especially as he does not count himself a teacher (excepting for the purposes of army draft questionnaires!) and has not taught beginners for many years.

On the other hand, I do wish to ask your consideration of several ideas bearing on the preservation of botanical knowledge and the rendering of it available to those who wish to use it in some way. You have all appreciated the fact that the storing and handling of scientific knowledge (as represented by the literature, and to some extent by herbarium and museum specimens) has recently become of the utmost importance. Botanical science is now so broad, and its wealth of knowledge is so great, that no worker can hope to read nearly all the papers appearing in his own field, to say nothing of those in related fields. It thus comes about that valuable bits of knowledge get lost in the pile, as it were, and fail to reach those persons who would be able to use them. It is a favorite "indoor sport" for scientists to find fault with their colleagues because the latter are not suitably familiar with the literature, but the critic is generally as lame as the poor cripple he derides. As I have remarked elsewhere, "science is in great danger of obliterating itself under its own productions, poisoning itself with its own excretions, like yeast." It is a very serious research to find out what is al-

ready known about any given topic, and matters grow daily worse.

Abstract journals can help greatly in this difficulty, and we are trying to improve conditions by starting *Botanical Abstracts*, an enterprise that is a cooperation of a large number of workers in botanical science "in its broadest sense." Some botanical journals, like the *Revue générale de Botanique* and the *Plant World*, occasionally publish résumés of the present status of knowledge regarding some limited topic. These are of great value if accompanied by accurate citations, and their number should be increased. Sometimes journals publish monographs more complete than résumés; for example, Jörgensen and Stiles' monograph on "Carbon Assimilation," which appeared in the *New Phytologist*. Such contributions should be encouraged, especially when they represent the cooperation of a number of workers and are accompanied by full and accurate citations. But, from apparently authoritative discussions of the status of a scientific field, by a single author and without citations of the literature, may whatever gods there be left deliver us!

But it needs to be emphasized that all these things are but makeshifts. We need to step forward boldly and state that our science, as well as all the others, needs, and needs very much, a *national or international institute for the furnishing of bibliographical information on request*. Such an institute would of course be a great undertaking, even for a field as narrow as botanical science, but it might well be the most productive investment that science (or humanity as a whole, even) could now make. It has been suggested that the establishment of such an institute for this country might well be by the National Research Council (which has been made permanent as you know), under the auspices of the National Academy of Sciences. And it has also been suggested that this proposed institute become the avatar of all those vague longings that find voice from time to time in pleas for a national university of some sort. Such an institute would have its permanent staff of departmental heads and its corps of

bibliographical assistants, but it would seek to have the full cooperation of all scientists. It would undertake to furnish bibliographies on any topic, with or without abstracts, and within reasonable time. I suspect that an organization of this kind might pay a good portion of its current expenses, through fees charged for the work done.—I might follow this dream into further detail, but I imagine the time is not yet ripe for that, what I wish to do here is to leave you with a very clear impression that this suggestion has great promise, that it is quite within the realm of possibility, and that it may ultimately be realized if we can unite in calling for it. It would avoid enormous wastes of time and energy on the part of many scientific workers and research institutions, and it would give congenial and dignified employment to many who wish to serve in scientific work but who may not find their best places as teachers or research workers.

Botanical Research.—Regarding research itself, and how we may best mobilize our limited strength so as to accelerate the advance of knowledge as much as may be, I shall confine my suggestions to three general topics: (a) the planning of research, (b) the procuring of data, and (c) the interpretation and presentation of results. But before we turn to the consideration of such suggestions as I may offer here, I ask your attention to two very striking characteristics of scientific research in general. First, scientific research is not recognized as an occupation or profession. We speak of research workers and emphasize the great value of their work to mankind, but the draft questionnaire (presumably the result of a number of able minds attempting to classify the possible occupations of our citizens) failed to show any such occupation. You might be a farmer or a blacksmith or a chauffeur, you might be a lawyer or a physician or a preacher, but you could not legally be a research worker or scientific investigator! An investigator in physiology might call himself a *teacher*—for he surely has to tell others about his findings—but this was misleading unless an explana-

tion was made. On the other hand, he might call himself an agricultural worker, engaged in an agricultural enterprise—since his physiological studies may frequently have something to do with agricultural plants—but this also was misleading and suggested familiarity with plows and manure-forks rather than with laboratory apparatus of precision.

My reason for introducing this somewhat startling observation is to call attention to the fact that scientific research is unorganized and unrecognized as a reputable occupation. Galileo had to steal away and perform his experiments in secret, on account of a devilishly inquisitive church, Leonardo had to get time for his researches between trips to the ducal palace to do odd jobs of repairing the plumbing and such-like things, and it appears that modern science has left this whole matter of research in much the same condition as that in which it was in those old times. A teacher may obtain some time for research between elementary classes in arithmetic or agronomy, a lawyer may carry on research on Sundays and holidays, but you must admit that, for the most part, scientific research is left to individual activity and is not sufficiently recognized to warrant official mention!

This is the more notable when we recall that the educational aspect of scientific responsibility is very thoroughly organized and largely standardized, with great government support of many kinds and with enormous endowments supporting libraries, museums, lectures. We have public recognition of the fact that knowledge is to be carefully preserved and passed on in available form to coming generations, but it is not as yet practically recognized that it is anybody's main business in life to increase knowledge through investigation.—It is a noteworthy fact that research is frequently expected of college and university teachers, that they are frequently appointed on the basis of published papers presenting the results of research, and it is just as noteworthy that such a teacher must generally carry on his investigations in a surreptitious way; his teaching activities are recognized but his research activities are not, even though their

results are expected and even demanded. In purchasing laboratory equipment for research it has indeed happened sometimes,—so I am told,—that research apparatus has been purchased under the false pretense that it was needed in teaching! If botanical research is one of our responsibilities as botanists, I submit that this anomaly demands some serious attention.

The other striking characteristic of much of our scientific research is this, that most of the published work appears to be done by *apprentices*. I refer to publications by beginners, like dissertations for the doctorate of philosophy in our universities. I can think of no other line of important human activity in which the work of apprentices looms so large as it does in botanical and other sciences. This state of affairs would not be so bad if the leaders under whose guidance the work has been done could take enough part in it to save the publications from the verge of futility. As would be expected of apprentice work, these publications frequently show poor planning and more frequently poor interpretation. The gathering of data may be well done, within the limits set by the plans. There seem to be some possible ways out of this difficulty, but I shall not take time here to mention even the ones I have had in mind.—I turn now to my three phases or aspects of research.

(a) *The Planning of Research*.—It has seemed to me that the planning of scientific investigation deserves very much more attention than it generally receives. Not having any clear aims, we are apt to be misled to the erroneous idea that all sorts of research are of equal importance. Perhaps it is not any longer fashionable to tell students that the mere gathering of facts in *any* field constitutes valuable scientific work, but we surely have not passed far beyond the conception that a personal and capricious interest is a proper and respectable guide in the choosing of a problem and in determining how it is to be carried out. It often seems that each worker brings forward his contributions without any notion as to how they are to fit into the struc-

ture of the science as a whole. It is somewhat as though each of us brought what he happened to have and threw it on a large and heterogeneous pile, hoping that a rational structure might, by some unknown means, be builded therefrom. We seem to feel little or no responsibility in the building itself, we bring contributions that can not be used at present and we let the building operations stop at many points because we do not bring the materials that are immediately needed.

A well-selected problem does not always mean a well-planned investigation, however; and an opportune problem has often led to great waste of time and work simply because the method of attack was hurriedly decided upon. As you have surely observed, experimental and observational investigation, as it is published, frequently shows what almost seems to be a genius for omitting the needed experimental controls. Again, things that are of relatively small importance are often dwelt on with great care, while the most outstanding points are woefully neglected. Needs that should have been cared for in the preliminary plan are often not appreciated until the experimental or observational work is completed, when it is too late to mend matters.

I have been led to think that this condition of affairs is largely due to a still more or less prevalent and very insidious fallacy, to the effect that a scientific investigator can not hope to find out what he sets out to find out, but has to drift with winds and currents and gather in the observations and results that he happens to run across. It is sometimes the business of a pioneer explorer to work in this way, but I think we should hardly call that sort of work scientific research in the modern sense. Discoveries of *facts* may be made now and then by chance and intuition, but discoveries of *relations* (with which our science now mostly deals) are largely to be made by taking serious thought as to just what we need to do in order to find out just what we set about finding out.

You have been warned earlier in this address of the fact that I regard cooperation as the touchstone by which we may hope to cure,

or at least alleviate, many of our scientific ills, and you will at once see that our selection of problems and our planning of projected investigations would be greatly improved if co-operation between competent thinkers were more in vogue. If every projected research involving considerable expenditure of money and energy might be submitted to several competent workers, with the request that they make suggestions, I have no doubt that much more valuable and feasible plans might result. It strikes one as a curious fact that scientific investigators wish to keep their work secret until it is finished (as they may fondly suppose), after which they are just as strong in their wish to present it to their colleagues. The results of investigation are frequently treated like Christmas gifts; they are planned and made in secret and handed to the recipients only after alterations are well-nigh impossible! And, finally, to complete the anomaly, the investigator is often sorely pained if his contribution proves to be very imperfect or even quite unacceptable! One wishes to ask why it would not be better to obtain the adverse criticism *before* the work was "finished," rather than to wait until after publication; the criticism will eventually be forthcoming in any event and it should be much more useful if it were made available early in the investigation. In so far as in us lies, we should avoid wasting our own time and facilities and those of our colleagues.

As I have emphasized elsewhere, it ought to be of enormous value to botanical science if some organization (perhaps the National Research Council) might publish yearly a list of what seem to be important and promising and feasible problems for botanical investigation, with elaborated plans. My imagination pictures this list as rather long, including all sorts of projects, sent in by numerous thinkers who have the well-being of their science really at heart, and I should expect it to alter from year to year, as projects get undertaken and results are obtained. It would be a fine thing if each society of research workers were to take upon itself the responsibility of furnishing such a series of proposals. This

should be accompanied by a usable bibliography of each problem, and mention should be made of investigators who might be engaged in this sort of work.

If this dream might come true such an annual publication might do more toward giving us a rather clear picture of the aims and trend of our science than could be secured from any other simple form of organized cooperative effort.

(b) *The Procuring of Data.*—After a research problem has been selected and properly planned, the securing of the requisite observational or experimental data is a matter of comparatively little difficulty. This is the easiest part of investigation and many publications consist of but little more than tabulations or lists of the data secured, without serious attempt to exhibit either plan or interpretation. This phase of research requires special attention less than do the other two and I need not dwell here upon it. I may suggest, however, that when practical difficulties arise during the progress of a piece of experimental or observational work, it would be well for the investigator to call upon some of his competent colleagues for advice, and it would also be well for the rapid advance of our science if the persons thus asked might respond in a wholehearted sort of way. Let it be remembered in this connection that botany is a world science and that its advance is not to be accelerated through the usual operation of institutional or individual rivalries and jealousies. Such motives may have value if rationally controlled, but they do not appear generally to result in the building up of an *esprit du corps* among scientists.

(c) *The Interpretation and Presentation of Results.*—It frequently follows that a good plan systematically carried out gives results that are largely interpreted by the plan itself. If a quarryman cuts an ashlar expressly for a certain position in a wall it is not necessary for him to explain to the builder just what is to be done with it when it is delivered. But the case is not nearly always so simple as this when complicated problems are under investigation. And most biological problems are still

so complicated (largely because they are chosen to embrace too large a field in each case) that special effort is required to find out what may be the meanings of the data at hand.

It appears that comparatively few writers take the trouble to interpret their results in anything like a logically complete manner. Our interpretations are generally hurried and are apt to be biased. Out of a large number of logically possible conclusions we are apt to state but one and to pretend that the facts support this hypothesis more than the others. Indeed, we usually write our discussion from the standpoint of a single one out of several or many logically possible hypotheses. The general result is that our literature abounds in published data which are either uninterpreted or illogically or incompletely interpreted. One of the greatest wastes in biological research lies, to my mind, in the publication of so many uninterpreted observations. To the beginner in research it may seem that a grateful science should be willing to interpret these data if the writer will just present them, but this is found not to occur in practise. As a general rule, if an author does not interpret his own results they remain uninterpreted and are finally lost in the maze of the literature; most active investigators do not like to attempt the study of the logical possibilities suggested by results obtained by some one else, especially as the plan followed in obtaining such results is apt to have been different from what the second investigator might wish to employ. It were better if we performed far fewer experiments and devoted much more time and energy and care to logical planning and thorough interpretations of the results we secure.

Just as in the case of choosing and planning an investigation, so in the case of interpreting observational and experimental data, several brains are preferable to one, and co-operation is greatly to be desired. It seems highly desirable, indeed, that several competent minds might be asked to make suggestions regarding any research, at several times, from its inception to the publication of the resulting contribution. If some of our critics might be asked to criticize our papers before they are published, a great many mistakes and

misunderstandings might be avoided and a good deal of personal jealousy and righteous or unrighteous indignation—both of which waste energy and time and money—might be prevented. Some of the standing committees of the Ecological Society of America have arranged for this sort of pre-publication criticism and it promises to be a valuable feature in raising the standard of research publication.

Responsibilities toward Applied Botanical Science.—In working over the mass of botanical knowledge that has already been obtained, for the purpose of presenting it to others, and also in selecting lines along which research is to be undertaken, we shall fail very seriously in the discharge of our responsibility unless we give special attention to the scientific and philosophical aspects of the application of our science to all the various needs of man. In a former publication² I have emphasized the fact that what is now commonly called applied science does not include nearly all of the applications of scientific knowledge. I take it that the term applied botany means to most of us *practical* applications in the arts, which serve the physical, esthetic and even the spiritual needs of mankind. Here belong agriculture, forestry, pharmacognosy, floriculture, such arts as dyeing, tanning, spinning, cooking, brewing (I believe there are still breweries somewhere in the world!), and many other important branches of human activity. These may be called practical applications, because they supply material things that are in demand and consequently have pronounced commercial value.

But there is another kind of application that is very important but that may not properly be called practical. I mean those applications that satisfy the intellectual or mental needs of mankind. Thus, chemistry, physics and climatology are applied in botanical science, and this science is in turn applied in chemistry, climatology, geology, psychology, philosophy, and so forth. In default of a better term I may call these *philosophical* applications. Here also belong the applications of one branch of our science to another branch, as

² Johns Hopkins University Circular, March, 1917.

when anatomy is applied in physiology, or when physiology is applied in ecology. While the philosophical applications of botany do not "take the eye and have the price" as do its practical applications, yet their value is universally acknowledged to be exceedingly great. They should not be left out of account in our proposals for a renewed mobilization of botanical scientists.

A consideration of these two groups of applications, called here the practical and the philosophical, will furnish a wealth of suggestions for research projects. It is the business of botanical scientists to supply all knowledge about plants that may be enquired for in behalf of any line of human activity. If we do not possess a certain kind of knowledge demanded by an art or another science, surely it is our responsibility to make the needed knowledge by research, and to do so as promptly after the need arises as is possible. Looked at in this way, the prevalent conception of botany as a composite of two different kinds of science, "pure" and "applied," is seen to strike very wide of the mark. In many ways it is to be regretted that many arts that employ applied science have come to be themselves called sciences, thus creating great confusion, but it were hopeless to try now to correct such illogical usages as those of agricultural science, medical science, veterinary science and the like. Agriculture, for example, is not a science, but an art, and whatever of science it employs is applied from botany, zoology, geology, climatology and so forth. (Of course it is understood that if plant physiology or the physiology of the wheat plant is regarded as a part of botany, so must animal physiology and the physiology of man be considered as a part of zoology.)

We are probably all in agreement as to the proposition that by far the greater portion of future botanical investigation will have to do with supplying botanical knowledge to the arts of agriculture, forestry and medicine—and the greatest of these is agriculture. Other speakers at these meeting will probably emphasize the scientific needs of this art—which they may call a science—and I need not here go farther in this connection.

If you agree with me that some of our greatest responsibilities have to do with the supplying of knowledge needed by the arts and the other sciences, and if you also agree that much of our advance is to come through cooperation, it naturally follows that botanical scientists must cooperate not only among themselves but also with workers in other sciences and in the arts.

In conclusion of this address, which may already be too long, I shall not attempt to summarize the various points and suggestions to a somewhat awkward presentation of which you have so kindly and patiently listened. I have voiced a longing for a conscious cooperation among scientists that has been felt by all of us, and I have placed before you a few suggestions as to some paths along which we may hope to proceed toward the realization of this desire. This address lays no claim to logical completeness but I think I may claim for it that it is facing in the right direction. We surely need to appreciate our responsibilities as botanists toward humanity and to take conscious steps toward the organization of rational campaigns against the demons of ignorance and superstition and waste. Now is the time of times, the "zero hour"; let us assume our responsibilities and do our share in the reorganization of human life for the new day that approaches. And let us not get in each other's way nor in the way of other groups of workers. We would give once again to botanical science her "place in the sun," but we would not do this by interposing any hindrances in the paths of the other sciences, with which we have no quarrels. Finally, we would accelerate the growth and unification and organization of our national science, not that we may excel in a national way (with a sort of colossal selfishness of an all-too-common type), but that we may serve world science to our utmost, thus gaining the supreme satisfaction of having appreciated our responsibilities and borne them in such manner as to receive, at last, our own approval.

BURTON EDWARD LIVINGSTON

THE JOHNS HOPKINS UNIVERSITY